SOURCES OF THE X-RAY BACKGROUND: TEMPORAL STABILITY

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The A2 experiment[1] on HEAO-1 was especially developed to make systematics-free measurements of the extragalactic X-ray background (Boldt et al. 1979) over the band (up to 60 keV) of maximum flux. The spectrum observed has a remarkably simple thermal form (Marshall et al. 1980) with a mean photon energy of about 40 keV, an order of magnitude above the high-energy limit of the Einstein Observatory (HEAO-2) telescope. If most of this hard X-ray flux is not diffuse, then the main sources of this background could be 1) unresolved objects of known classification (e.g. BL Lac type, quasars, active galaxies) at high redshift, 2) redshifted ($z > 1$) gamma-ray bursts and/or 3) a new class of X-ray objects peculiar to high redshifts. If we assume that the number of such sources that are highly variable is less than 10^6, then our first-cut analysis of the temporal stability measured for the X-ray background indicates that 1) their contribution is less than 15% if they are variable on scales less than 10^4 seconds, and 2) their contribution is less than 60% if they are variable on scales less than a half-year.

Boldt, E., Marshall, F., Mushotzky R., Holt, S., Rothschild, R., and Serlemitsos, P., in Proceedings of COSPAR/IAU Symposium on X-ray Astronomy (edited by W. Baity and L. Peterson) Pergamon Press: Oxford and New York, p. 443, 1979.

Marshall, F., Boldt, E., Holt, S., Miller, R., Mushotzky, R., Rose, L.A., Rothschild, R., and Serlemitsos, P., 1980, Ap. J., in press.

[1]The A2 experiment on HEAO-1 is a collaborative effort led by E. Boldt of GSFC and G. Garmire of CIT, with collaborators at GSFC, CIT, JPL and UCB.

G.O. Abell and P. J. E. Peebles (eds.), Objects of High Redshift, 227–228.

DISCUSSION

Epstein: Why did you choose, in modelling the short-term variations, a time scale of less than 0.5 hours -- because of a priori information on the intrinsic nature of the sources or simply to have a time scale much less than your total observation time of 9 hours?

Boldt: Since the averages considered here are for bins of half-hour duration, we must deal with two regimes of temporal variability, viz., $\tau < 1/2$ hour and $\tau \gtrsim 1/2$ hour. The variance to be associated with the shorter regime is singled out since it represents the minimal effort to be expected among scales of variability less than the total 9-hour exposure.

Masson: In your models of the effect of quasar variability, what form did you take for the variations and what fraction of the total flux was assumed to vary?

Boldt: A source is considered variable when the time-average of (S^2) is large compared with $(\langle S \rangle)^2$.

Peebles: If the N(S) slope is not steep enough, most of the variance of the X-ray flux comes from the nearest quasar. Does this happen?

Boldt: We assume that the slope of the log N-log S relation is steeper than that for an index of 2, such as the index 2.3 discussed for quasars by Schmidt (this symposium) and Setti and Woltjer (Astronomy and Astrophysics, 1979). In such a situation, the variance comes from sources close to the lowest S (i.e., the most distant sources).

https://doi.org/10.1017/S0074180900068571 Published online by Cambridge University Press